

The Ceylonese species of *Balanocarpus* Bedd. (Dipterocarpaceæ)

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Summary : Two species of *Balanocarpus* are known from Ceylon, one (*B. kitulgallensis*) described here for the first time, the other (*B. brevipetiolaris* (Thw.) Alston), formerly included in *Hopea* by ASHTON.

Résumé : Deux espèces de *Balanocarpus* existent à Ceylan, l'une (*B. kitulgallensis*) dont la première description est donnée ici, l'autre (*B. brevipetiolaris* (Thw.) Alston), placée dans le genre *Hopea* par ASHTON.

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BALANOCARPUS Beddome

Forest Man., Addend. : 236 (1873); Fl. Sylvat., tab. 330 & 331 (1874); TRIMEN, Handb. Fl. Ceylon 1 : 130 (1893); BRANDIS, J. Linn. Soc. 31 : 106 (1895); ALSTON, in TRIMEN, Handb. Fl. Ceylon 6 (Suppl.) : 26 (1931); GAMBLE, Fl. Madras : 84 (1935); BOLE, Kew Bull. 1951 : 145-146 (1951); ASHTON, Blumea 20 (2) : 359 (1972), as a synonym of *Hopea*.

Trees. Stipules minute, early caducous. Flowers in axillary panicles, the rachis bearing distichous racemes. Calyx of 5 imbricate segments, somewhat united at the base. Petals 5, somewhat connate at the base (falling as a rosette); corolla cup-shaped or urceolate, the apical part of the lobes obliquely enrolled. Stamens 15 (or irregular from 9 to 15) in two whorls (outer of 10), very small; filaments triangular, flat; anthers small, sub-globose, deeply divided into 2 parts, dehiscent laterally; connectival appendage filiform, as long as the anthers. Ovary elongate-ovate, merging into a sub-conical style; stigma punctulate. Fruit elongate-ovate, glossy, longitudinally striped or ridged, strongly apiculate. Sepals somewhat enlarged under the fruit, not wing like, the 3 outer ones with thickened saccate base, strongly imbricate; the two inner ones thinner, the sepals more or less adpressed to the fruit. Embryo of two unequal cotyledons, each deeply divided into two parts.

TYPE SPECIES : *Balanocarpus erosa* Beddome.

The genus is represented in Malesia and in India (2 species); it was described by BEDDOME after two S. Indian species : *B. erosa* and *B. utilis*.

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DYER, J. Bot. 3 : 154 (1874), concluded that his *Hopea longifolia*, Fl. Brit. Ind. 1 : 309 (Jan. 1874), based on *Beddome s.n.* from Tinnevely, S. India, was conspecific with *Balanocarpus utilis* Beddome, Fl. Sylv. : tab. 330 (1874) and GAMBLE accepted the reduction, Fl. Madras : 84 (1915).

BOLE (Kew Bull. 1951 : 145-146) discussed the status of *Dioticarpus barryi* Dunn (Kew Bull. 1920 : 337), a genus which DUNN had separated from *Balanocarpus* because of the 2-winged fruit. BOLE examined the two only fruit bearing specimens of *Dioticarpus barryi* Dunn in the Madras Herbarium, *Coimbatore 3464* (the type specimen in Kew has no fruit, neither drawing of fruit) and arrived at the following conclusion, after having studied the literature of the Malesian species :

« FOXWORTHY, J. Arn. Arb. 27 : 347 (1946), in his account of the distribution of *Dipterocarpaceæ*, is inclined to consider *Balanocarpus erosa* Bedd. as a species of *Hopea* Roxb. The author (BOLE) of the present note very reluctantly has to disagree from such a view until further anatomical and morphological evidence be brought forward. The fruit morphology of these two species of *Balanocarpus* (i.e. *B. erosa* Bedd. and *B. heimii* King) is so different from that of *Hopea* Roxb., that their retention in a separate genus seems to be justified ».

How ASHTON, Blumea 20 (2) : 369 (1972), who quotes BOLE can conclude : « BOLE's correct reduction of the genus *Balanocarpus* to *Hopea* » is a riddle as BOLE concluded just the opposite !

Of *Balanocarpus utilis* BOLE believed, that it was conspecific with *Dioticarpus barryi* Dunn, but as he was aware, that fruit of *Dioticarpus* had 2 wings and *Balanocarpus* no wings, he made the nonsensical assumption, that both kinds of fruit could occur on the same tree, « this point needs further elucidation from field-workers » (BOLE). BOLE apparently never was in the field !

But notwithstanding BOLE's own suggestion for waiting for confirmation, he proceeded to refer *Balanocarpus utilis* to *Hopea*, giving *Dioticarpus barryi* as a synonym.

It goes without saying, that *Balanocarpus utilis* is not a *Hopea* and that *Dioticarpus barryi* is not conspecific with it. The latter should be compared with *Hopea wightiana*.

If *Balanocarpus* has to be accommodated in another genus, the logical choice is *Shorea*, not *Hopea*, because of the three slightly larger, at base thickened sepals under the fruit. The number of stamens militates against *Shorea*, but since ASHTON included *Doona* with 15 stamens in *Shorea*, also this obstacle is gone.

I am not inclined to make hasty conclusions, and as *Balanocarpus* with its 2 Indian and 2 Ceylonese species is a close unit, I prefer to retain it as a separate genus.

In his Manual of Dipterocarp trees of Brunei State : 91 (1964), ASHTON included the 3 Ceylonese species of *Hopea* (including *Balanocarpus brevipetiolaris*) in the section *Hopea*, characterized by a scalariform nervation and a smooth bark or regularly flaky. Since then he included *Balanocarpus brevipetiolaris* in *Hopea* with *reticulate* venation, which upsets the sectional subdivision.

Moreover *B. brevipetiolaris* is very close to *B. kitulgallensis*, the latter with scalariform reticulation. By creating sections, based on nervation, closely related species may become separated.

KEY TO THE CEYLONESE SPECIES

1. Leaves coriaceous, venation reticulate, subacuminately gradually tapered, 3-5
 × 7-14 cm, with 5-7 pairs of lateral nerves..... 1. *B. brevipetiolaris*
 1'. Leaves chartaceous, secondary nerves scalariform, caudate-acuminate, 2-3.5
 × 4.5-5 cm, with 3 (rarely 4) pairs of lateral nerves..... 2. *B. kitulgallensis*

1. **Balanocarpus brevipetiolaris** (Thw.) Alston

- In* TRIMEN, Handb. Fl. Ceylon 6 : 26 (1931) ; ASHTON, *in* DASSANAYAKE, Revised Handb. Fl. Ceylon 1 (2) : 172 (1977) and *ibid.* 1 : 376 (1980), as a synonym of *Hopea brevipetiolaris* (Thw.) Ashton.
 — *Shorea brevipetiolaris* THW., *in* TRIMEN, J. Bot. 23 : 205, tab. II, fig. 22, 23 (1885) ; Handb. Fl. Ceylon 1 : 130 (1893), as a doubtful synonym of *Balanocarpus* (?) *zeylanicus* Trim. ; BRANDIS, J. Linn. Soc. 31 : 108 (1895) ; WORTHINGTON, Ceylon Trees : 69 (1959) ; ASHTON, *l.c.* : 172 (1977) and *ibid.* : 376 (1980), as a synonym of *Hopea brevipetiolaris*. — Typus : *Thwaites C.P. 4008, s. loc., ster.*
 — *Hopea brevipetiolaris* (Thw.) ASHTON, Blumea 20 (2) : 359 (1972) ; *in* DASSANAYAKE, *l.c.* : 172 (1977) and *ibid.* : 376 (1980).
 — *Balanocarpus* (?) *zeylanicus* TRIMEN, J. Bot. 27 : 161 (1889) ; Handb. Fl. Ceylon 1 : 130, tab. 14 (1893) ; BRANDIS, J. Linn. Soc. 31 : 108 (1895) ; LAWIS, Veget. Prod. Ceylon : 43 (1934) ; ASHTON, *l.c.* : 172 (1977) and *ibid.* : 376 (1980), *in syn.* ; type : Unnumbered specimen in bud from a cultivated tree in the Botan. Gard., Peradeniya (PDA).

TYPE : see note below.

Tree, up to 20 m high, dbh. 90 cm, coppicing at the base, bole regular, sometimes branchlets pendulous. Buttresses none or small ; bark smooth, greyish to tawny brown, in older trees rough, dark brown, peeling in strips, thin, live bark pale yellow brown, sapwood dark brown, hard. Pendulous branches very densely brown puberulous (hairs erect), disappearing on non-pendulous ones. Stipules narrowly triangular, 1-2 mm, early caducous. Leaves coriaceous, glabrous, ovate, 3-5 × 7-14 cm, gradually tapered to a blunt, subacuminate acumen, base rounded to cordate ; above glossy dark green, smooth, midrib slender, impressed, lateral nerves inconspicuous or slightly impressed ; below paler, glossy, midrib rather slender, prominent, lateral nerves slender, rather erect, slightly arcuate, prominent, 5-7 pairs, sometimes with pits in the axils ; secondary nerves not scalariform ; reticulation obscure. Petiole 4-13 mm long, either very densely puberulous (hairs erect) or glabrous, slit-like channeled above.

Panicles slender, 1-3 from leaf axils, singly branched, 4-18 cm long, slightly (denser on basal part of main peduncle), very minutely puberulous, the spreading, alternate branches slender, up to 5 cm long, bearing 5-10 flowers. Pedicels slender, 1-2 mm long. Sepals broadly ovate, acutish, subequal, 2 mm long, free to the base, erect-patent. Petals pale yellow, slightly connate at base into a cup-shaped urceolate cup, 4 mm long (dropping as a cup-shaped rosette, 4-5 mm in diam., apical part convolute sideways). Stamens (from 9 to 15), some opposite the others, irregular (in one tree), very small ; filaments long, white, very broadly triangular, the apical part filiform, anthers 0.25-0.50 mm, subglobose, connectival appendage filiform, acute, as long as the anther. Ovary smooth, elongate ovoid with as long, acute, narrowly conical style.

Fruit elongate ovoid, acutish, apiculate, glossy, smooth, up to 13 × 10 mm, striated, pericarp thin, brittle, the persistent calyx lobes adpressed to the fruit, glabrous, ovate-

orbicular, the 3 outer ones thicker, thickened at the base, hardly longer than the inner two, up to 5 mm long. Embryo green; each of the unequal cots completely divided into two parts (TRIMEN).

DISTRIBUTION : Now only found on the slopes and the summit of Doluwe and Dun Kande, near Kurunegala, up to 600 m altitude; as trees are found at the base of Dunkande near Arankelle and at the hills opposite it, it may be assumed that the species must have been common also in the plains between the hills.

ECOLOGY : A normally developed tree with straight bole of 20 m height, was found at the base of Dunkande near Arankelle. The tree is extremely common on the flat top of Doluwe Kande at 600 m alt. and its adjacent slopes, but because of adverse conditions it is here stunted with short, crooked boles, sprouting several boles, and more coppicing than the trees lower down, (although these have numerous root-suckers). The bark of older, regular tree boles looks quite different from the smooth, greyish younger stages. Trees with long pendulous branches were seen occasionally.

NOTES : The type specimen is a sterile shoot from an unknown locality (ASHTON says from Doluwe Kande, perhaps based on an assumption). It shows the deeply cordate leaves and dense puberulence of a young tree. TRIMEN stressed that its origin was not known and he added it to the synonymy of his own species : *Balanocarpus zeylanicus* with an interrogation mark, stressing in a note, that THWAITES'S sterile shoot might represent another species. As *B. zeylanicus* is based on another type specimen, TRIMEN did not transfer *Shorea brevipetiolaris* Thw. to *Balanocarpus*, as ASHTON says, but created a new species, adding in synonymy as a doubtful synonym *Shorea brevipetiolaris* Thw. and hence his name is not illegitimate (as ASHTON says).

There is one specimen in Peradeniya with flowers in bud, collected in the Peradeniya Garden, which is probably the specimen mentioned by TRIMEN. I have indicated this as the lectotype specimen.

In the description ASHTON calls the tree "medium sized, but up to 35 m tall and up to 3 m girth". This is perhaps a mistake for feet (not meters). The petals are more orbicular-ovate to orbicular then oblong-ovate as described by ASHTON and their enrolled, oblique tip which is so characteristic, is not described, neither the cup-shaped or urceolate corolla. The statement, that there are 10 or 15 stamens is wrong, I have counted them in 50 flowers : there are 9, 10, 11, 12, 13, 14 or mostly 15 stamens, some opposite each other. The garden specimen flowered in May, during 2 weeks after a long (4 weeks) period of flower development.

The name *Dunmala*, given by ASHTON is wrong. *Dummala* (not *Dunmala*) means resin and is given to any Dipterocarpaceous tree, when no other name is known (*dummala* from dhuma, Sanskrit = fume, used as an incense). Our tree produces hardly any resin and nobody collects it.

SPECIMENS EXAMINED : Ashton 2053, Doluwe Kande, ster. (PDA); 2105, cult. in Botan. Garden, Peradeniya, April, buds (PDA); de Silva 49, 51, eod. loc., May, fl. (PDA); s.n., eod. loc., Aug., fr. (PDA); Jayasuriya & Balasubramaniam 537, Kurunegala, Dunkande, Arankelle, ster. (PDA); 540, Doluwe Kande (PDA); Kostermans 28441, cult. in Botan. Garden, Peradeniya,

April, fl. (AAU, G, L); 28459, Kurunegala, Dunkande, Arankelle, May, fl. (PDA); 28467, Doluwe Kande, May, buds (AAU, G, L, PDA); *Livera s.n.*, cult. in Botan. Garden, Peradeniya, June, young fr. (PDA); *Meijer 372*, Kurunegala, Dunkande, Arankelle (PDA); 819, cult. in Botan. Garden, Peradeniya, July, young fr. (PDA); *J. M. Silva s.n.*, *eod. loc.*, July, fr. (PDA); *ibid.*, April, buds (PDA); *s. coll. C.P. 4008*, Kurunegala Distr., N.W., ster. (PDA); *s. coll., s.n.*, Doluwe Kande, Sept. 1888, young fr. (PDA); *ibid.*, May 1884, buds (PDA); *ibid.*, Dec. 1883, young pl. (PDA); *ibid.*, cult. in Botan. Garden, Peradeniya, Jan. 1888, fl. (PDA).

2. *Balanocarpus kitulgallensis* Kosterm., *sp. nov.*

Arbor mediocris, ramulis sub-penduliferis, foliis chartaceis glabris ovatis caudato-acuminatis parvis concoloribus, supra laevibus nervo mediano prominulis vel planis pilosis, subtus dense minutissime reticulatis, nervo mediano tenuibus prominulis, costis gracilibus prominentibus, prominulis, prominente arcuatis 3 raro 4 paribus, nervis secundariis parallelis horizontalibus gracilibus conjunctis, petiolis gracilibus dense pilosis, paniculis paucifloris, filiformibus subglabris parvis, fructus subsessilibus, sepalis aequalis basi incrassatis, imbricatis, parte connatis, fructus immaturus anguste ovoideus acutis nitidis.

TYPE : *Kostermans 28385* (holo-, L).

Tree 6 m, dbh. 10 cm. Bark smooth, light brown, thin. Live bark 3 mm, light brown. Branchlets sub-pendulous, slender, densely pubescent (hairs erect). Leaves chartaceous, ovate, 2-3.5 × 4.5-5 cm, caudate-acuminate (acumen slender, up to 1.5 cm long), base rounded; above glossy, glabrous, except the slightly prominulous slender midrib (may be also level with the surface), which is densely pilose, lateral nerves faint; below glabrous, except hirsute domatia in the axils of the strongly arcuate, 3 (rarely 4) pairs of slender, prominent lateral nerves, midrib slender, prominent, secondary nerves faint, prominulous, parallel, all horizontal. Petiole slender, 5-8 mm long, very densely pubescent (hairs erect).

Infructescences axillary, filiformous, very sparsely, very minute puberulous, rather few-flowered, few-branched, paniculate, up to 5 cm long, the longest filiform branches 2 cm long.

Fruit almost sessile, sub-globose, up to 8 × 10 mm, glabrous, glossy, the 5 sepals of about equal length, thickened at the base, strongly imbricate, ca. 10 mm long, ovate, acutish, the basal 1-2 mm connate. The 3 outer slightly larger and thicker. Fruit elongate-ovoid, acute, smooth, glossy with style remnant.

DISTRIBUTION : Only known from the type locality.

NOTE : Close to *B. brevipetiolaris*, but differs by the smaller, chartaceous leaves with few (3 versus 5-7) pairs of lateral nerves, a more minute reticulation and typical horizontal, parallel secondary veins, the filiform, almost glabrous, much smaller panicles (not panicles of racemes) and the almost sessile fruit (flowers). Stamens were not present at the time of collection.

SPECIMENS EXAMINED : *Kostermans 27385*, Kitulgalle, across Kelaniya R. near a flat rock-bottomed tributary, which ends opposite the Kitulgalle Resthouse, alt. 150 m, May, young fr. (AAU, G, L, PDA); 28485, *ibid.*, May, ripe fr. (AAU, G, L, PDA).

ADDENDUM

ASHTON (Gard. Bull. Singapore 31 : 27, 1978) accommodated *Balanocarpus heimii* King in a new genus : *Neobalanocarpus* Ashton. He gave it the status of a *nomen novum*, but it is a new genus.